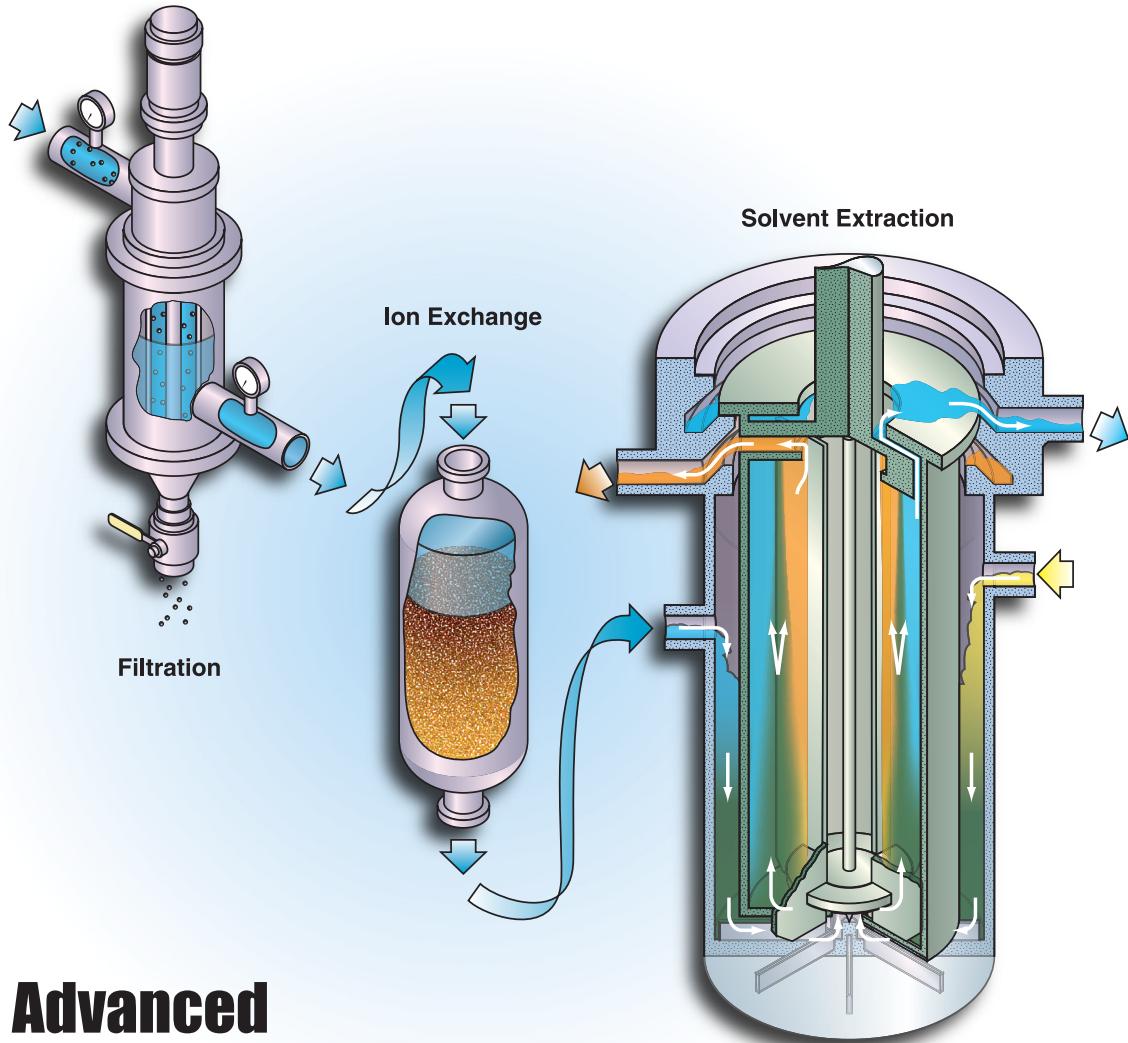


**INL is world renowned for its expertise in and development of solvent extraction, ion exchange/adsorption, and filtration processes and equipment.**



## Advanced Separation Technologies

The Advanced Separations and Radiochemistry Department at the Idaho National Laboratory (INL) is composed of scientists and engineers that specialize in a variety of chemical and physical separation technologies. They are world renowned for their expertise in and development of solvent extraction, ion exchange/adsorption, and filtration processes and equipment. Experience gained in both

the Department of Energy complex as well as in commercial industry provides the unique capabilities to make chemical and physical separations more effective and economical. Improving the end product through advanced separation technologies provides a real advantage in today's competitive industrial market. More efficient separations improve the quality and quantity of the product and rapidly returns the capital investment while

reducing or even eliminating by-products and waste.

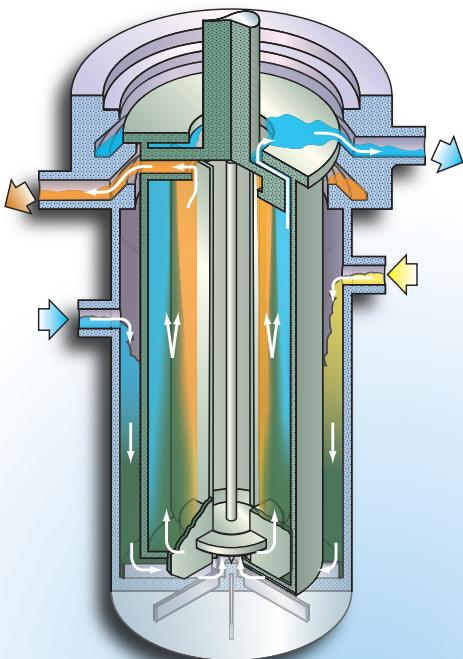
### Process Intensification

Achieving fast and selective separations with high product recovery calls for the latest technologies and applications tailored to meet demanding process needs. After conducting a complete process evaluation, the Separations Team applies existing technologies or develops new ones, combining the right mix of science and

*Continued next page*

Nuclear Programs





*This bank of four 5 cm diameter rotor contactors employs transparent housings for mixing and fluid discharge evaluations as well as all stainless units for use with aggressive solvents and remote application design.*

*Continued from previous page*

applied engineering to fully maximize the separation process. Numerous patents have been awarded to team members for both process and equipment design innovations. Whether flowsheet development, process conversion from batch to continuous mode, process scale-up, startup, testing, or modeling, the Separations Team has the know-how to deliver highly beneficial consulting services. From laboratory to production scale, or even from concept through demonstration of a custom separation, we can provide cost effective testing and development. We will provide the needed answers on process design, throughput, product quality, and cost to enable decisions based on facts, not promises. Process intensification means faster, better, less expensive processing is accomplished with savings in

manpower, energy, product, and time.

#### **Solvent Extraction**

The Separations Team specializes in liquid-liquid centrifuges known as annular centrifugal contactors. These patented devices are designed to replace multiple tanks, mixer settlers, and countercurrent columns in solvent extraction processes that have fast kinetics (when the transfer of the desired material from one liquid phase to another happens in a few seconds). On an even broader scope, this technology is being used to convert industrial processes from batch to continuous in separation, washing, extraction and reaction operations.

Single and multi-stage contactor advantages:

- Extraction efficiency of 90% or greater in a single unit
- Lower in-process volume and solvent inventory
- Mixing and separation in seconds
- Rapid phase coalescence at 200-400 G's of force



*The INL is developing high volume solvent extraction process flowsheets using 12.5 cm diameter rotor contactors with throughputs of up to 20 liters per minute.*

- Tolerance to rapid changes in flow rate and ratio of phases
- Equilibrium in minutes, versus hours or days
- Minimal facilities required due to small footprint
- Gravity feed and discharge capability
- Direct stage connections for countercurrent processing.

Services offered include design, development, modeling, and testing of separation processes for industrial applications. The INL has laboratories, pilot plants, and shielded cells for contactor studies in a wide range of single and multi-stage processes. Centrifugal contactors of various designs and sizes are available for

contract research, development, and proof of principle, on a wide variety of feedstocks. The result is innovative separation processes that improve yield, save money and time, and reduce waste.

### ***Ion Exchange and Adsorption***

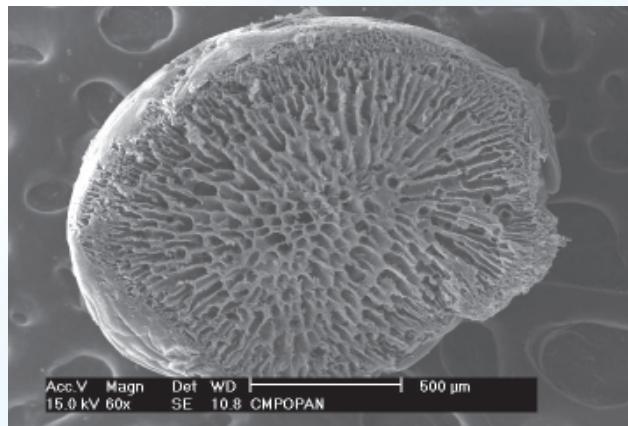
Team members have a wide range of experience in the development, design, and application of ion exchange/adsorption separations for difficult applications. For example, one specialty is efficiently separating desired species from streams with high concentrations of competing ions or compounds. The team synthesizes highly selective and high-capacity media or modifies

existing materials to improve kinetics, capacity, and mechanical properties. Several patented technologies are available for commercial applications.

Media packed columns perform like a large number of batch contactors in series where each “layer” generates a more pure product stream than the preceding one. As such, this technology can provide very efficient, high purity separations in a very small footprint.

Laboratory and pilot-scale tests are made to evaluate proposed separation technologies. INL radiological facilities enable the team to employ radioactive “tracers” for

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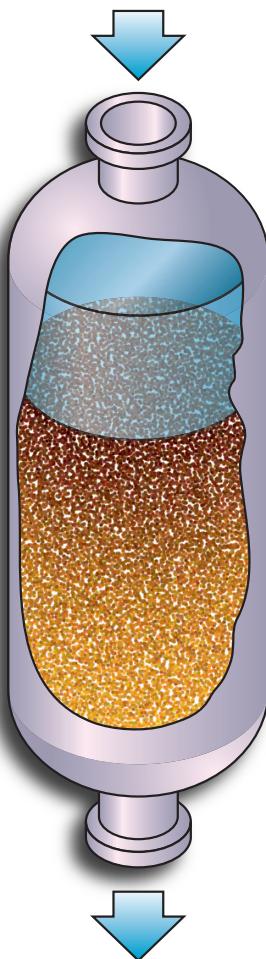
**SEM micrograph of highly porous adsorption media developed at the INL.**



**Pilot scale ion exchange column testing.**



**Bench-scale apparatus for testing ion exchange materials.**



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process development and testing, facilitating quick, accurate, low cost measurement of system performance.

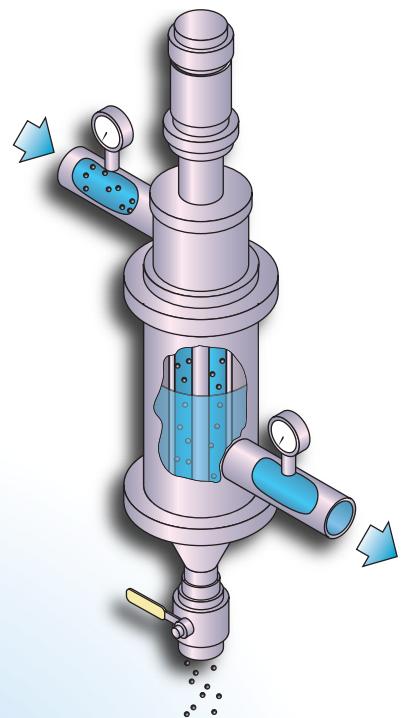
### Filtration

For any given solid/liquid separation, the team determines the best filter media and filter type available to meet the specific process demands. Tests are then performed to optimize operation, develop physical or chemical cleaning cycles, as well as the means to monitor filter performance. This selection and evaluation ensures that the right equipment and process steps are installed giving the best cost/benefit ratio and eliminating the frustration of trial and error filter tests at the production facility.

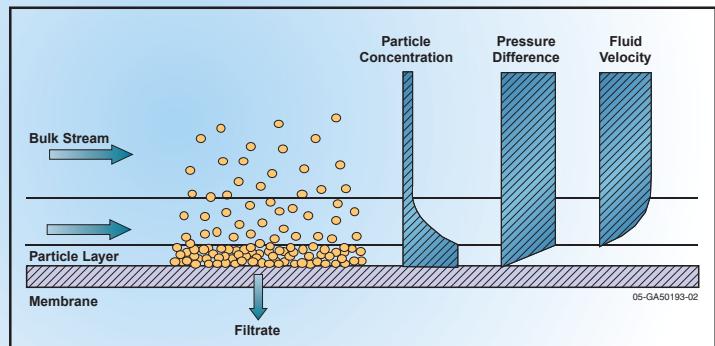
Members of the team have extensive expertise in the design and testing of micro and ultrafiltration membranes, candle filters, and cross-flow filters using either tubular or rotating circular membranes. Tested applications range from biomass (hydrolysate)

separations or sugar feedstocks processing to highly radioactive nuclear waste partitioning. Filtration systems design and evaluation services are available to meet the needs of a wide range of industrial applications.

Rapid and efficient evaluation of tubular membranes for self cleaning cross flow filters is conducted in our Cells Unit Filter apparatus. Automation of difficult filtration operations saves man hours and money as compared to more conventional techniques. Additional laboratory and pilot plant facilities are also available for process evaluations at production rates.



### Cross Flow Filtration



### For more information:

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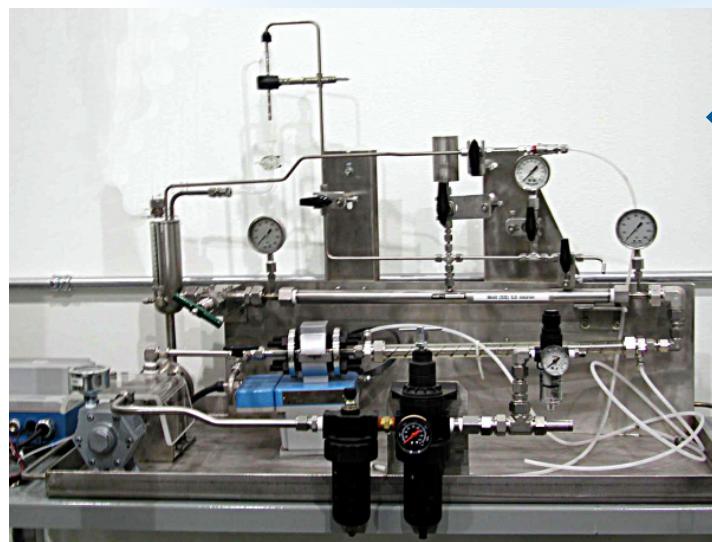
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Bench-scale cross-flow filter apparatus for testing ultra-filtration methods.